

Claims

- [c1] 1. A system for monitoring performance of an apparatus, comprising:
a plurality of operational components functioning in said apparatus, each operational component with a predetermined nominal operating state and each generating respective electrical signals pursuant to their operation; a data collection memory in said apparatus storing samples of said electrical signals in a rolling buffer;
an analyzer in said apparatus responsive to said electrical signals for detecting a trigger event indicative of at least a potential variance of an operational component from its nominal operating state;
a computation center located remotely from said apparatus and having a database storing representations of electrical signals for classifying nominal and irregular operating states of said operational components; and
a transmitter activated by said trigger event to transmit at least some of said stored samples in said rolling buffer at the time of said trigger event to said computation center;
wherein said computation center receives said transmitted samples and classifies them according to said nominal or irregular operating states.
- [c2] 2. The system of claim 1 wherein said apparatus is comprised of a motor vehicle and said transmitter is a wireless transmitter.
- [c3] 3. The system of claim 1 wherein said samples transmitted by said transmitter are comprised of a predetermined subset of said electrical signals.
- [c4] 4. The system of claim 3 wherein said predetermined subset is chosen from a plurality of subsets in response to said electrical signals.
- [c5] 5. The system of claim 3 wherein said predetermined subset is chosen from a plurality of subsets in response to a control signal received from said computation center.
- [c6] 6. The system of claim 1 wherein said transmitter transmits stored samples collected over a predetermined time interval spanning said trigger event.
- [c7] 7. The system of claim 6 wherein said samples transmitted by said transmitter

are comprised of a predetermined subset of said electrical signals.

- [c8] 8. The system of claim 7 wherein said transmitted samples collected prior to said trigger event correspond to a first predetermined subset of said electrical signals and said transmitted samples collected after said trigger event correspond to a second predetermined subset of said electrical signals.
- [c9] 9. The system of claim 8 wherein said second predetermined subset of said electrical signals is determined in response to a source of said trigger event.
- [c10] 10. The system of claim 1 wherein said samples summarize an operational history of said vehicle and said computation center analyzes a severity of operation for various system components in order to project operational lifetime in response to said samples.
- [c11] 11. The system of claim 1 wherein said operational components include electronic modules having respective microcontrollers, and wherein said samples include input and output signals of said microcontrollers.
- [c12] 12. The system of claim 1 wherein said operational components include electronic modules having respective microcontrollers, and wherein said samples include memory contents within said microcontrollers.
- [c13] 13. The system of claim 1 wherein said operational components include sensors and actuators, and wherein said samples include electrical signals from and to said sensors and actuators.
- [c14] 14. The system of claim 1 wherein said operational components include electronic modules having respective microcontrollers, and wherein said trigger event is comprised of the detection of the setting of a predetermined flag in one of said microcontrollers.
- [c15] 15. The system of claim 1 wherein said operational components include electronic modules having respective microcontrollers, and wherein said trigger event is comprised of the detection of the setting of a predetermined diagnostic code in one of said microcontrollers.

- [c16] 16. The system of claim 1 wherein said analyzer compares at least one sample with a predetermined threshold, and wherein said trigger event is generated in response to said comparison.
- [c17] 17. The system of claim 1 wherein said analyzer compares stored samples in said rolling buffer to a predetermined pattern, and wherein said trigger event is generated in response to said comparison.
- [c18] 18. The system of claim 17 wherein said predetermined pattern is comprised of a histogram.
- [c19] 19. The system of claim 1 wherein said analyzer determines an average value of a predetermined electrical signal over time, compares said average value to a predetermined average threshold, and generates said trigger event in response to said comparison.
- [c20] 20. The system of claim 1 wherein said analyzer performs a predetermined analysis routine to detect said trigger event.
- [c21] 21. The system of claim 20 wherein said transmitter is comprised of a transceiver and wherein said predetermined analysis routine is downloaded from said computation center via said transceiver.
- [c22] 22. The system of claim 1 wherein said trigger event is detected in response to an elapsed period of time.
- [c23] 23. The system of claim 2 further comprising an operator interface for displaying messages from said computation center in response to a classification of transmitted samples.
- [c24] 24. The system of claim 1 wherein said computation center adjusts said database in response to said transmitted samples so that said adjusted database is used for future classifications of other apparatus by said computation center.